AL/OE-TR-1995-0114

ARMSTRONG LABORATORY

SELECT WASTEWATER CHARACTERIZATION SURVEY, CLEAR AIR FORCE STATION, ALASKA

Christopher A. Williston, Captain, USAF

OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
Bioenvironmental Engineering Division
2402 E Drive
Brooks Air Force Base, Texas 78235-5114

July 1995

Final Technical Report for Period 11 - 19 April 1995

Approved for public release; distribution is unlimited

AIR FORCE MATERIEL COMMAND
BROOKS AIR FORCE BASE, TEXAS

NOTICES

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data., is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

Government agencies and their contractors registered with Defense Technical Information Center (DTIC) should direct requests for copies to: DTIC, Building #5, Cameron Station, 5010 Duke Street, Alexandria, VA 22304-6145.

Non-Government agencies may purchase copies of this report from: National Technical Information Services (NTIS), 5285 Port Royal Road, Springfield, VA 22161-2103.

Christopher A. Williston

CHRISTOPHER A. WILLISTON, Capt, USAF, BSC
Project Engineer, Water Quality Branch

James D. Montgomery

JAMES D. MONTGOMERY, Lt Col, USAF, BSC
Chief, Bioenvironmental Engineering Division

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
July 1995

3. REPORT TYPE AND DATES COVERED
Final 11-19 April 1995

4. TITLE AND SUBTITLE
SELECT WASTEWATER CHARACTERIZATION SURVEY, CLEAR AIR FORCE STATION, ALASKA

5. FUNDING NUMBERS

6. AUTHOR(S)
Capt Christopher A. Williston

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Armstrong Laboratory (AFMC)
Occupational and Environmental Health Directorate
Bioenvironmental Engineering Division
2402 E Drive
Brooks Air Force Base, TX 78235-5114

8. PERFORMING ORGANIZATION REPORT NUMBER
AL/OE-TR-1995-0114

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Personnel from the Armstrong Laboratory Water Quality Branch conducted a follow up wastewater characterization survey for HQ/AFSPC at Clear Air Force Station, Alaska from 11-19 April 1995. he scope of this survey was to sample specific outfalls that were not evaluated or available during the previous 1992 survey. In addition, there were several areas that required evaluation to ascertain if they required an industrial discharge permit.

The cooling system for the Power Plant was also evaluated for water and wastewater issues. There is currently a large volume of makeup water created each day, requiring caustic soda and sulfuric acid treatment. These chemicals, along with chlorine have been responsible for fish kills. A better system can be installed, and the current steam plumbing system modified to minimize the use of chemical treatment and mitigate potential future excursions.

14. SUBJECT TERMS
Oil/Water Separators
Fish Kills
Industrial Wastewater Permits
Cooling Towers for Power Plants

15. NUMBER OF PAGES
20

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. DISCUSSION	1
II.A. Background	1
II.B. Classification and Permit Issues	2
II.B.1. Vehicle Maintenance and the Fire Department	2
II.B.2. The Machine Fabrication and Sheet Metal Shop	2
II.C. Wastewater Site Considerations	3
II.D. Sampling Strategy	3
II.E. Sampling Methods	3
II.F. Field Quality Assurance/Quality Control (QA/QC)	4
II.G. Analytical Laboratory QA/QC	4
III. POWER PLANT ISSUES	5
III.A. Steam Heating and Makeup Water	5
III.B. Cooling System	5
III.C. Cooling Pond	6
III.D. Coal Piles	6
IV. RESULTS AND CONCLUSIONS	6
IV.A. Oils, Greases, and Total Petroleum Hydrocarbons	8
IV.B. Phenol	8
IV.C. Total Metals	9
IV.D. Volatile Organic Compounds	9
V. SUMMARY AND RECOMMENDATIONS	9
V.A. Leachate Fields	9
V.B. Industrial Permits	10
V.C. The Power Plant	10
References	12

TABLES

OIL/WATER SEPARATOR AND SEPTIC TANK SURVEY DATA 7

ACKNOWLEDGMENTS

We greatly appreciate the invaluable support provided by the Bioenvironmental Engineering Office at Eielson AFB, Alaska. Our supplies were lost in shipping but we were able to fulfill the sampling requirements with the assistance of the BEE shop.

We would also like to express our gratitude to the following Clear Air Force Station personnel: Mr. Wendell Shoemaker at the Power Plant for the extensive explanations of the various systems at the Power Plant and the Thaw Shed, and Jay Reader and Ed Hogan for clarifying and accessing the Tech Center sanitary systems.

SELECT WASTEWATER CHARACTERIZATION SURVEY,
CLEAR AIR FORCE STATION, ALASKA

I. INTRODUCTION

Personnel from the Water Quality Branch, Armstrong Laboratory, Brooks AFB, Texas conducted a wastewater characterization survey at Clear Air Force Station (AFS), Alaska, from 11-19 April 1995. The purpose of this survey was to further characterize the wastewater at strategic locations that were not present or obtainable during the 1992 survey (See AL-TR-1993-0031, Wastewater Characterization Survey, Clear Air Force Station, Alaska). These additional locations were in response to HQ AFSPC concerns of industrial activities and industrial characterization from the base. In addition, groundwater impact concerns were expressed from the Technical Center, Fabrication Shop, Sheet Metal Shop, and Thaw Shed since these locations discharge into local septic and leaching fields.

The wastewater characterization survey was requested by 21 AMDS/SGPB 21 Space Command, Peterson Air Force Base, Colorado. Capt Christopher Williston of Armstrong Laboratory performed the survey.

II. DISCUSSION

II.A. Background

Clear AFS is a small installation operated mostly by contractors. There are approximately 110 military personnel, 56 civil service workers and 160 contractor personnel responsible for Clear's important mission. For further descriptions see above referenced technical report.

The 21th Space Warning Squadron is the host organization which supervises, monitors and discharges the operational function of Ballistic Missile Early Warning System (BMEWS); supervises and directs operation of the Power Plant and Fire Department; and exercises overall command of Clear AFS.

Federal Services Corporation (FSC) is the contractor responsible for the operation, maintenance, and support of the BMEWS. FSC assumed operations and maintenance responsibilities effective 1 September 1975.

We shipped our equipment to Clear AS with a due date of 13 April 1995, but our sampling equipment never arrived during the survey. The Bioenvironmental Engineering Shop at Eielson AFB supplied us with samplers, sample bottles, reagents, and coolers so that we could complete the majority of the planned sampling activities.

II.B. Wastewater Classification and Permit Issues

There is a concern whether Clear AFS is an industrial or a domestic discharger. Domestic wastewater is defined by Metcalf and Eddy, 1991, as: 'Wastewater discharged from residences and from commercial, institutional and similar facilities'. Industrial wastewater is defined as, 'Wastewater in which industrial wastes predominate'. The sanitary sewage system that is treated by the Imhoff tank at Clear AFS is a domestic system according to these definitions.

II.B.1. Vehicle Maintenance and the Fire Department

The minor flow rates from the fire department and vehicle maintenance are predominantly bathroom discharges. The flow from the oil/water separator in vehicle maintenance is minimal in comparison. There are no industrialized process waters such as ones found at logistic bases or where intense overhaul maintenance is conducted discharging to this system. The vehicle maintenance operations at this facility mitigate spills with speedy-dry and rags, and does not treat oily water wastes through the oil/water separator. This oil/water separator is not designed to be, nor is used as a treatment system, but rather a spill contingency tool. Therefore, it should not require an industrial permit. The base should consider retracting this permit.

The oil/water separator was sampled for oil and grease by contractor personnel earlier, and the concentration was approximately 16 mg/L. If the level is below 50 mg/L, it is considered a weak wastewater and should be of no consequence to the sanitary sewage system (Metcalf and Eddy, 1991 and Laboratory Services Guide, 1994).

The Fire Department had intermittent flow. The flow that was observed during the survey was sanitary. The floor drains in the truck bay area were dry. This facility does not conduct drive train maintenance. Discussions with the Fire Chief indicated that they do not even wash the vehicles in the bay. The vehicles are occasionally wiped down. Therefore, there appears to be is no need for an oil/water separator or an industrial permit as recommended by 21 HQ AFSPC.

II.B.2. The Machine Fabrication and Sheet Metal Shop

The Machine Fabrication (Bldg 51) and Sheet Metal Shop (Bldg 26) both discharge into a septic leach field and are not connected to the main sanitary system. The operations and sanitary discharge were inspected at both facilities. Building 51 also has the base Auto Hobby Shop located on the east side. The floor drains at this area have been plugged. The main machine shop area had the floor drains plugged with the exception of one 3-inch drain. Visual inspection

indicated that this drain has not been used in many years. The machine shop foreman and the supervisor for Environmental and Health Services assured us that this drain may have been missed when all of the others were plugged, but they will plug this one. The Sheet Metal Shop had no open floor drains, and the only discharge to the septic field appeared to be the small bathroom. No painting activities were conducted at this the Sheet Metal Shop.

The only sewage effluents coming from out of these buildings are from the bathrooms. There were only three machinists working out of the Bldg 51 facility during the day that we inspected this facility for one shift. There were no sheet metal technicians present during the visual inspection. Any discharge from these buildings would be a very minor flow and would not justify connecting the discharge up to the main system over 200 yards away. Again, the predominant wastewater discharge is domestic sanitary sewage and not an industrial waste stream. These locations should not require an industrial permit.

II.C. Wastewater Site Considerations

This survey included several site investigations and five sampling points. The site investigations included the base Machine Fabrication Shop, the base Sheet Metal Shop, each discharge sanitary sewage into septic leach fields; Vehicle Maintenance oil/water separator, and Power Plant non-contact cooling water. The five sampling sites are: Power Plant oil/water separator; Thaw Shed; and Buildings 101, 102 and 106.

II.D. Sampling Strategy

A presurvey was not conducted since the project engineer was familiar with the facility. 21 AMDS/SGPB Director of Bioenvironmental Engineering, Major Dan Turek outlined most of the outfalls of concern and the sampling parameters.

II.E. Sampling Methods

Wastewater samples were typically collected with a stainless steel grab sampler. Each of these sampling sites was a type of reservoir with a retention time of several hours to days, depending on the flow rate. Each sample was collected by dipping the sampler into liquid surface in a effort to capture any floatable product. Volatile Organic Aromatic (VOA) borsilicate 40 mL bottles were prefilled with approximately 2-3 drops of hydrochloric acid reagent. These were filled with sample so as to not wash out the preservative, sealed with no visible air bubbles, wrapped in bubble wrap and iced for shipping. The non-VOA samples jars were filled to 90% capacity, sealed and iced for shipment to Eielson AFB. The samples were transported to Eielson AFB the same day and preserved with appropriate reagents and placed directly into the sample

refrigerator. The water sample pH and temperature were taken from each waste stream sample taken.

The next day, samples were placed in shipping coolers, packed with blue ice, shock insulated, transported to Eielson's Packing and Crating, and shipped via overnight courier to AL/OEA for analysis.

All samples were collected and analyzed using EPA approved procedures. Sample preservation was in accordance with the Armstrong Laboratory Recommended Sampling Procedures, commonly referred to as the AL Sampling Guide, dated October 1994.

II.F. Field Quality Assurance/Quality Control (QA/QC)

Usually a field QA/QC program would be used during this survey to verify the accuracy and reproducibility of laboratory results. Since we had not received our equipment for the Clear survey, and we had just completed the Eielson AFB survey that week, we decided to evaluate the QA/QC data of the equipment blanks, reagent blanks, spikes, and sample duplicates for any anomalous concern. The completed QA/QC data from Eielson did not indicate any areas of concern regarding cross contamination from reagents and duplicate sample results were within ten percent variance.

II.G. Analytical Laboratory QA/QC

The Armstrong Laboratory Analytical Services Division Quality Assurance Plan establishes the guidelines and rules necessary to meet the analytical requirements of 43 states, US EPA, and private accrediting agencies. The laboratory is certified by the Alaskan DEC to perform drinking water analyses. Specific activities include: (a) inserting a minimum of one blind sample control for each parameter analyzed on a monthly basis, (b) periodic audit of the quality assurance items from each branch, (c) daily calibration of equipment, (d) a minimum of one National Institute Standards and Technology/Standard Reference Materials (NIST/SRM) traceable standard and control sample is included with each analytical run, (e) corrective action is documented each time a quality assurance is not met, (f) all sample data will have established detection limits, (g) participation by the laboratory in numerous proficiency surveys and interlaboratory quality evaluation programs, and (h) plotting and tracking of all quality control samples by the appropriate analytical section.

Quality assurance is also mandatory for all contracted analytical services and is validated on a periodic basis by Armstrong Laboratory personnel.

III. POWER PLANT ISSUES

III.A. Steam Heating and Makeup Water

The power plant is responsible for supplying steam for heating and cooking, and electricity for the entire Air Station. One of the problems that plagues the power plant is the continuous makeup water requirement due to line loss in the heating system. According to discussions with the Power Plant personnel, approximately 140 drums of sulfuric acid and 160 drums of caustic soda are shipped in each year and consumed in the production of makeup water.

Makeup water is groundwater that is purified through chemical precipitation. 25-35K gallons or more of makeup water is made each day to replace the line loss water. If the heating system were changed over to a hot water system, then the leaking steam traps could be removed and each line between buildings could be leak tested to locate other losses. A heat exchanger could be built adjacent to the power plant and the cost savings for the reduction of chemicals would pay for the refurbishment in a short time period. The Tech Center does not return the makeup water; it is wasted to the local fish hatchery along with the non-contact cooling water to enhance fry growth from the warmed water and to remove the fry excrement.

The effluent cooling water discharge from the power plant was measured for pH during this survey. Two readings indicated 11-12 pH. Thirty minutes later it was read 6-7 pH. The chemicals used in the makeup water must be flushed out and commingle with the cooling water, consequently altering the total effluent pH. These extreme pH changes would also be reduced, if not eliminated, if the steam heating and cooking system were to be changed over to hot water.

More exact figures in chemical and cost reduction could be calculated in a feasibility study. A firm that specializes in these kinds of systems and climates should be selected. Low bid contractors from outside Alaska may not be capable of rendering the best solution.

III.B. Cooling System

The Power Plant uses the cooling pond to cool some of the sub-systems inside of the plant. Originally, there was a cooling tower that failed over the years. A cooling pond was installed to treat the elevated water temperatures. The current system works during the spring, fall and winter. The problem is that during the summer, the temperature differential is not great enough to rely on just recycling the pond water and colder well water is required. This in turn is discharged into the cooling pond and eventually overflows to the ditch that leads to Lake Sansing. This ditch is also used by the Alaskan Department of Fisheries to discharge non-contact cooling water from the Tech Site. There are ample numbers of trout in this ditch. When chemical treatment in the power plant is not balanced properly, it may pass through the cooling

pond and into the ditch. Several fish kills have resulted from accidental chemical releases and cooling pond overflow resulting in State and Federal agency involvement.

III.C. Cooling Pond

Several issues must be considered. This cooling pond is not lined and the Power Plant often uses chemicals for water treatment. It is also not reliable for cooling during warm weather. A new cooling tower should be built near the power plant either as the sole cooling system, or in conjunction with the cooling pond. For a small portion of the year the cooling tower could be used to supplement the cooling pond's performance, and then the remainder of the year it could be in the standby mode. This may allow for extended life of the tower versus a full time system. The other consideration is that because the cooling pond is not lined, it has periodic algae growth and is susceptible to weather extremes. A better alternative would be a permanent closed loop cooling tower operation which would further minimize chemical treatment requirements for algae, reduce water quality variations, minimize requirements for a long distance plumbing system, and eliminate the potential for chemical releases into the environment.

The unwanted prolific (5M estimated) goldfish in the cooling pond are also causing problems with the power plant. These small fish are plugging up intake filters. These are exotic species and have no business in the Alaska ecosystem, let alone a closed system cooling pond. Discussions with HQ AFSPC have indicated that these fish have been eradicated, and there should be no survivors to procreate.

III.D. The Coal Piles

There is some debate regarding storm water runoff near the coal piles. There is shallow swale that surface water runoff could enter if there was enough precipitation. Some of the coal dust and other particulate matter could run downstream. Sediment transport can be easily controlled with straw bales placed in the swale. With natural coal seams exposed to creeks less than 40 miles away, and local city power plants allowed to stage their coal piles adjacent to fish laden rivers, this inland location for Clear AFS coal pile would not appear to have a serious environmental impact. Clear AFS should work with the Alaskan DEC to clarify regulatory requirements regarding their coal piles and stormwater considerations.

IV. RESULTS AND CONCLUSIONS

Contaminant concentrations and physical and chemical parameter values are presented in the following table to characterize the various wastewater streams sampled during the survey. Some

Base Survey: CLEAR AS ALASKA

Survey Dates: 17 - 21 APRIL 1995

OIL/WATER SEPARATOR AND SEPTIC TANK SURVEY

	POWER PLANT O/W	THAW SHED O/W SEP	BLDG 106 SEPTIC	BLDG 101 SEPTIC	BLDG 102 SEPTIC
	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE
GROUP A ANALYTES (mg/L)	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995
Oil and Grease	1.5	19.4	492	1.8	4.8
Total Petroleum Hydrocarbon	<1	14.2	408	1.6	2.7
GROUP E ANALYTES (ug/L)					
Phenols	<10	<10	<10	<10	<10
GROUP F ANALYTES (mg/L)					
Aluminum	0.042	4.12	0.104	<0.030	0.077
Antimony	0.022	<0.006	<0.006	<0.006	<0.006
Arsenic	<0.010	<0.010	0.024	<0.010	<0.010
Barium	<0.005	0.634	0.139	<0.005	<0.050
Beryllium	<0.004	<0.004	<0.004	<0.004	<0.004
Cadmium	<0.005	0.007	<0.005	<0.005	0.005
Calcium	28.9	31.8	59.3	26	33.9
Total Chromium	<0.010	0.016	<0.010	<0.010	<0.010
Cobalt	<0.050	<0.050	<0.050	<0.050	<0.050
Copper	<0.020	0.09	0.918	0.032	0.04
Hardness	97	105	198	89	116
Iron	<0.030	13.6	1.52	<0.030	1.19
Lead	<0.020	0.173	0.035	<0.020	<0.020
Magnesium	6.1	6.1	12.1	5.8	7.7
Manganese	<0.030	0.073	<0.030	<0.030	<0.030
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum	<0.030	<0.030	<0.030	<0.030	<0.030
Nickel	<0.030	<0.030	<0.030	<0.030	<0.030
Selenium	<0.010	<0.010	<0.010	<0.010	<0.010
Silver	<0.010	<0.010	<0.010	<0.010	<0.010
Thallium	<0.002	<0.002	<0.002	<0.002	<0.002
Titanium	<0.050	0.164	<0.050	<0.050	<0.050
Vanadium	<0.050	<0.050	<0.050	<0.050	<0.050
Zinc	<0.050	0.244	3.01	<0.050	0.078
ON SITE ANALYSES					
pH (units)	6.5	5.5	6.5	7	7
Temperature (°C)	30	25	16	34	20
SAMPLE NUMBERS	GN950490	GN950492	GN950494	GN950496	GN950498
	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE	COLLECTION DATE
VOLATILE COMPOUNDS (ug/L)	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995	TUES, 18 APRIL 1995
Benzene	<1.0	<1.0	<1.0	<1.0	<1.0
Bromodichloromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorodibromomethane	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorethylvinyl Ether	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0
Trans-1,2-Dichloroethene	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	<1.0	<1.0	<1.0	<1.0	<1.0
Cis-1,3-Dichloropropene	<1.0	<1.0	<1.0	<1.0	<1.0
Trans-1,3-Dichloropropene	<1.0	<1.0	<1.0	<1.0	<1.0
Ethyl Benzene	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene Chloride	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethylene	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	<1.0	<1.0	<1.0	<1.0	1.26
1,1,1-Trichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethylene	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	<1.0	<1.0	<1.0	<1.0	<1.0
o-Xylene	<1.0	<1.0	<1.0	<1.0	<1.0
m-Xylene	<1.0	<1.0	<1.0	<1.0	<1.0
p-Xylene	<1.0	<1.0	<1.0	<1.0	<1.0
SAMPLE NUMBER	GN950491	GN950493	GN950495	GN950497	GN950499

of the concentrations reported illuminate potential concerns with current disposal methods. Other concentrations simply contribute to the identifying characteristics of the wastewater that reflect the types of materials being disposed of through the septic system.

IV.A. Oils, Greases, and Total Petroleum Hydrocarbons

Oil and Grease (O&G) is not a specific analyses in that a group of substances with similar properties are determined due to their solubility in trichlorotrifluoroethane. Some of these compounds could include organic dyes, sulfur compounds, and chlorophyll. Total Petroleum Hydrocarbons (TPH) compounds are extracted and analyzed in the same manner as O&G; however, after measuring for O&G with an infrared detector, a silica gel is added to the sample to adsorb the nonpetroleum compounds and remeasured (Standard Methods 19th Edition). TPH compounds detected may come from detergents and other domestic sources, and not necessarily fuels.

If a site or source discharges less than 50 mg/L of O&G at the building boundary (versus a process vessel prior to discharge), then the effluent from that process(es) is considered a weak wastewater concentration, (Metcalf and Eddy 1991) and should not be considered a detrimental impact to the sanitary system. If the concentration is higher than 150 mg/L, then it is considered a strong concentration and may form a greasy coating of lines and pipes. Higher concentrations can cause large grease balls to form at lift stations and impact mechanical operations. These septic systems should not have a problem the low concentrations detected, except for Building 106. The highest O&G sample detected was at Bldg 106, the Scanner Building at 492 mg/L. These scanner buildings are usually unmanned and do not have much activity. The Total Petroleum Hydrocarbon (TPH) concentration was 408 mg/L; this would suggest that the source was probably petroleum, oils, or lubricants (POL). Most sanitary treatment with activated sludge or continuous aeration systems can handle higher concentrations. These effluents, however, are only going to septic leach fields. If the concentration were more elevated, then some plugging could occur before the bacteria could digest it. This might require more frequent pumping of the septic tank; however, due to the low flow conditions, there may be no noticeable impacts to the septic system.

IV.B. Phenols

No phenols were detected at the three sites sampled. Phenols are found in many compound from cough syrup to cleaning soaps. The wastewater samples were analyzed for this parameter to determine if excess cleaning compounds were used.

IV.C. Total Metals

As stated in the previous survey report, "Many drinking wells and water supply wells in this geologic area draw water from a metamorphic schist stratum, (Ms. Vanessa Brevens, Alaska DEC, 1993). This formation is usually high in minerals to include arsenic, silver, lead, barium, and chromium."

There were no levels of metals detected that would cause concern. There were trace levels of cadmium and lead and other metals at the Thaw Shed and Bldg 106. One source of copper and zinc in the sanitary water may be from copper plumbing, brass faucets, and galvanized metal janitor sinks. It would be hard to characterize the sources with the relatively levels detected without sampling the source well water for that facility.

The field test results do not indicate abnormal operations at these facilities. The elevated temperature values for the Power Plant and Building 101 are attributed to elevated room temperatures and wasted makeup water, respectively.

IV.D. Volatile Organic Compounds

Volatile Organic Compounds (VOCs) were analyzed via EPA Methods 601 (Volatile Organic Hydrocarbons) and 602 (Volatile Organic Aromatics). VOCs are widely used in many products and are also by-products of ongoing processes throughout any Air Force base. Usually the small amounts that enter the sanitary system are treated by biodegradation or volatilization. Volatile compounds would normally be biodegraded in a septic system through anaerobic digestion. These compounds are usually hydrophobic in nature and will adsorb to organic material such as soils, activated carbon, septic waste, etc. When these trace compounds are discharged to a sanitary septic system, the fate transport would result in the majority of these compounds adsorbing to the solids portions of the waste stream and settling to the bottom to be biodegraded anaerobically. If more concentrated levels were discharged to the system, and were to pass through the septic tank and into the leach field, then these compounds would most likely adsorb to the soils in the immediate vicinity of the field tile and biodegrade there. Only large amounts, such as a fuel spill, would pass through the system, flow with the water fraction and get past the immediate leach field area. The operations do not present this kind of situation at Clear AFS. The sample results indicate one minor detection of toluene (1.26 ug/L) at the Radar Transmitter Building 102.

V. SUMMARY AND RECOMMENDATIONS

V.A. Leachate Fields

The analytical results indicate no abnormal discharges into the leachate fields from these five locations. The source of TPH at Bldg 106 should be investigated and mitigated. If the levels are elevated then the source should be determined.

V.B. Industrial Permits

There should be no reason for industrial permits for the effluents from vehicle maintenance, sheet metal, the fire department, and the fabrication shop. This will result in unnecessary analytical monitoring and permit fees without providing any environmental benefit. Prudent shop surveys, inspections and training will accomplish better control in what goes down the drain.

V.C. The Power Plant

The power plant is an essential component for the operations conducted at Clear AFS. The cooling system should be remodeled to mitigate chemical use and releases. Mr. Wendell Shoemaker, the superintendent, has an intimate knowledge of the operations of this plant and discussed the remodeling projects that would nearly eliminate the acid and caustic soda consumption of makeup water by converting the steam heating and cooking system to a hot water heat exchanger. This changeover will also help ensure discharge compliance to the cooling pond/reject ditch system. The excessive pH swings from creating makeup water are very difficult to control.

A closed loop cooling tower system would eliminate the need for the cooling pond. This would eliminate periodic algae removal requirements and potential conflicts between the cooling pond operation and wildlife well-being. The energy requirements for the continuous pumping for the cooling tower would be offset by reducing or eliminating the deep well and return line pumping requirements.

If these two changes are implemented, then the remaining issue would be the limited makeup water generation. There will be a more severe pH change in that there would be no dilution from the cooling water currently discharging. Since the makeup water requirements would be reduced, it would not have to be replenished as often and it may be possible to change the process to include a neutralization batch tank, controlled with buffers, prior to discharge. Another consideration is to install a Reverse Osmosis (RO) or resin system in place of the current methodology. The RO systems have improved in the last five years and are now more economical, especially with the small volumes of water that would be treated. With the line loss eliminated by the retrofitted hot water system, the plant would only require a small RO system. A cost feasibility study should be performed to determine if a RO system is warranted and cost effective in comparison to the acid/caustic soda treatment currently used. The cost of a new RO

system may be significantly less than a compliance NOV due to the discharge of high or low pH water.

References

Laboratory Services Guide; AL/OE-TR-1994-0136; Occupational and Environmental Health Directorate, Brooks Air Force Base, Texas; 1994.

Wastewater Engineering Treatment, Disposal, and Reuse; Metcalf & Eddy, Inc.; McGraw-Hill, Inc.; 1991.

Water Quality and Treatment: a handbook of community water supplies, American Water Works Association, 4th ed., 1990